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Published in:
Exploring Teaching for Active Learning in Engineering Education

Publication date:
2017

Document Version
Publisher's PDF, also known as Version of record

Link back to DTU Orbit

Citation (APA):
Basaiawmoit, R. V., Dahlgaard, M., Løje, H., Sørensen, S. M., & Lindahl Thomassen, M. (2017). Are we building at tower of Babel? Active learning in teaching about, for, through invention, innovation or entrepreneurship. In *Exploring Teaching for Active Learning in Engineering Education: Book of abstracts* (pp. 31-33). IUPN - Ingeniør Uddannelsernes Pædagogiske Netværk.

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Are we building at tower of Babel? Active learning in teaching about, for, through invention, innovation or entrepreneurship

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ABSTRACT
Keywords - Active Learning, Entrepreneurship Education, Innovation, Invention, CDIO

Please indicate clearly the type of contribution you are submitting: _X__ hands-on, ___explore, ____poster.

Background and explanation
There is an increasing trend in the use of "Active Learning" in engineering education (de Graaff *et al.* 2004), moving towards a "learner-centered" model from a more passive "teacher-centered" one. There has also been, in parallel, an increase in educating through/in innovation **and** entrepreneurship with an emphasis to encourage engineering students to develop competences through experience based learning designs (Xia *et al.* 2016). Indeed, the establishment of entrepreneurship education programmes in engineering education are a testimony to this trend. Active learning methodologies are widely adopted in entrepreneurship education. How to balance entrepreneurship education in education "about", "for" or "through" entrepreneurship is however still debated (Heionen & Hytti, 2010; Taru & Juha, 2016). Increasing demands for skilled engineers who can develop new solutions through invention and innovation have pushed universities to meet this demand from industry and society at large, which in turn have led to a plethora of entrepreneurship programs being developed within Engineering Education – some more hastily than others (Spee & Basaiawmoit, 2016; Maddock, 2013). These programs have either an implicit or explicit focus on developing student competences within invention, innovation and entrepreneurship without having clear demarcations of these concepts within the frame of program design (Toner & Tompkins, 2008). However, are we creating a "Tower of Babel" in the building of such programs without taking into account the fundamental differences and overlaps between invention, innovation and entrepreneurship?

With our workshop and the following "work-in-progress" paper we aim to answer this question and detangle the usage of these terms in the framing of education programs within engineering education. Furthermore, we use the CDIO framework (Crawley *et al.* 2011) as a guide to understand active learning methods within educational designs to understand the place of invention, innovation and entrepreneurship in engineering education program design. With the use of cases, anecdotes and theoretical references, a paper will be developed with the aim of recommending a broadly accepted language framework to design new engineering education programs for invention, innovation and entrepreneurship.

Set-up

At the hands-on session the participants will be divided into smaller groups and be introduced to the CDIO framework. Each group will have time to discuss the framing of entrepreneurship education programs within engineering education based on their own knowledge/experience. There will be two rounds where the participants will discuss in groups. The first round will have focus on "definition" and "context" usage of the participants using innovation, invention and entrepreneurship in their own programs. In the second round the participants will discuss CDIO as an educational framework and how they work with the four CDIO elements in their learning designs. At the end of the session, the groups will present a sum up of their discussions.

In each group one of the authors will be present to collect information. At the end of the session the authors will present their work and results so far and sum up on the results from the hands on session.

Expected outcomes

The expected outcome from the hands on session is more knowledge on how framing of entrepreneurship and innovation education programs is done within different engineering educations, which will be included in a recommendation for a language framework to design new engineering education programs. We also expect to use the knowledge gained together with our own empirical data and combine them into a journal article that would be then shared with the participants but also with the engineering education community at large.

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